W. R. LIMBURG

relays for industry

RELAYS SWITCHES

AUTOMATIC ELECTRIC

NORTHLAKE, ILLINOIS

Automatic Electric Company pioneered the use of reliable telephone-type relays in industrial applications. Today, the bulk of automatically operated machines use relays and switches of a type developed by A.E.

Our diverse family of industrial controls includes seven principal classes of relays in many varieties of coil and spring pile-up combinations, with wide latitude in operate and release times, and for either a.c. or d.c. operation.

Further, we manufacture rotary stepping switches, such as the Type 44 and the Type 45, along with the versatile, cam-operated OCS Stepping Relay (these are described in Circular 1698 and Catalog 4071).

A.E. also specializes in the hermetic sealing of individual relays and switches, or combinations of these to form industrial control "package units."

In short, Automatic Electric Company has the experience, reputation, manufacturing facilities, research staff, and down-to-earth, practical "know-how" to help solve your knottiest control problem.

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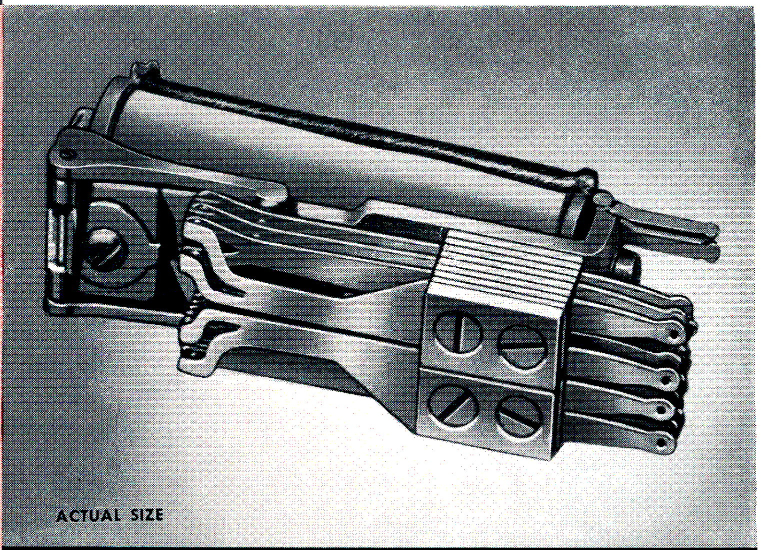
FEATURED PRODUCTS

CLASS B RELAY

Finest telephone-type relay available is the famous Class B all-purpose "workhorse." Characterized by dependable operation and long life, it weighs 8 to 14 oz., and measures 4-1/8″ x 2-1/4″ x 1-1/32″.

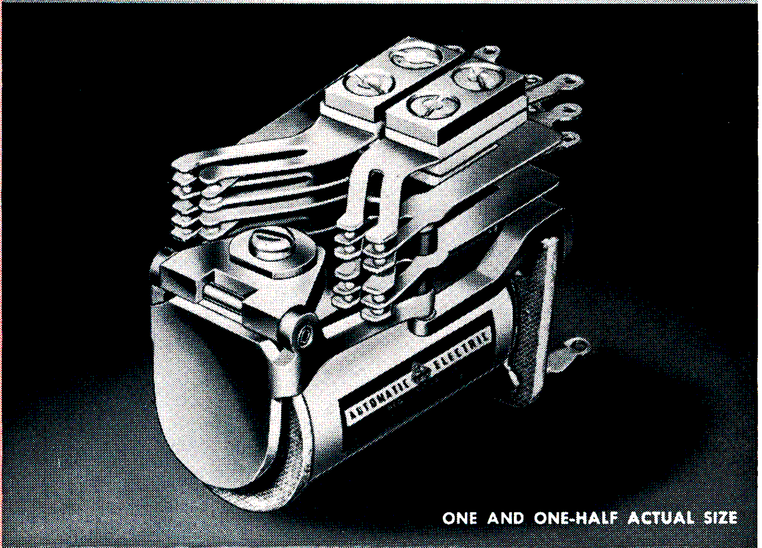
Mechanical life expectancy — 400 million operations.



ACTUAL SIZE

CLASS E RELAY

Intermediate size Class E relay reduces the best of the Class B features to a minimum of space and weight. Life of 200 million operations, and upwards, is available from this relay.

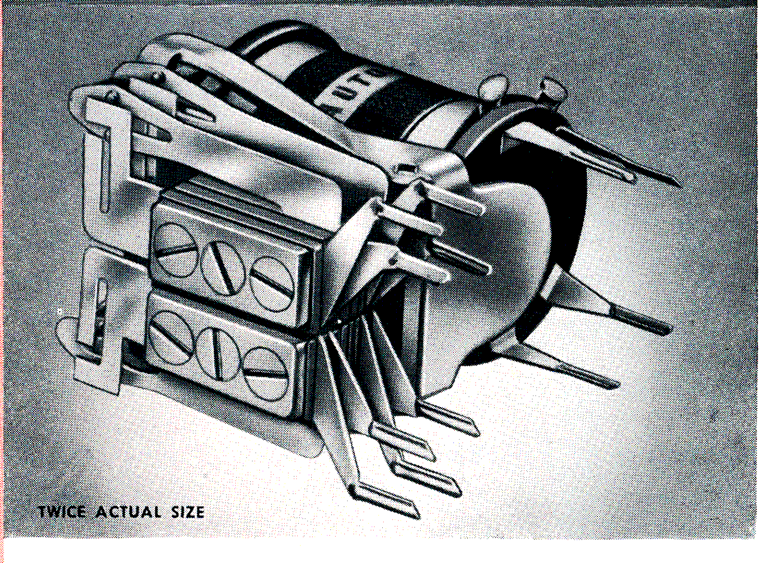


ONE AND ONE-HALF ACTUAL SIZE

SERIES SQPC RELAY

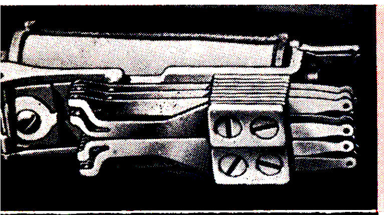
For Printed Circuits. Series SQPC is designed for direct insertion into printed circuit boards. This space- and weight-saver is used in aircraft and similar applications. Only 1-3/4″ x 1-3/4″ x 1″; weight — 2-1/2 to 3 oz.

Mechanical life expectancy — 120 million operations.



TWICE ACTUAL SIZE

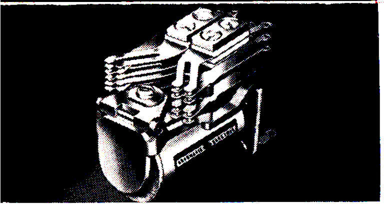
CHOOSE FROM THIS WIDE RANGE OF TYPES



CLASS B

FOR OUTSTANDING ENDURANCE AND DEPENDABILITY

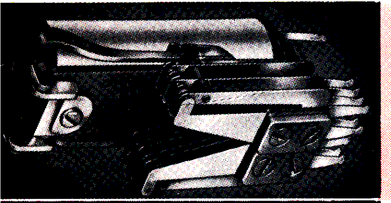
When extremely long service and reliable operation are demanded, this relay meets the requirements. Life often exceeds 400 million operations. Ideal for computers, fire control, pulsing or switching functions. Choose the Class B relay for the most exacting high-speed or marginal operations. For AC or DC operation.



CLASS E

A HUSKY NEW SPACE-SAVER

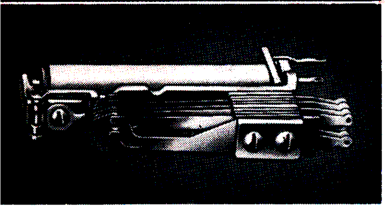
Introducing a new telephone-type relay, designed for dependable long-life industrial service . . . where weight and space considerations determine size limitations. Based on the rugged Class B design, this is a universal relay, engineered for a variety of uses demanding compact size coupled with our usual high standard of reliability.



CLASS A

WHEN FIRST COST IS IMPORTANT

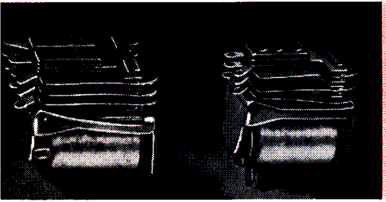
When you want relays that will hold down costs, yet provide dependable operation and long-life, specify the Automatic Electric Class A relay. This is the original "telephone-type" relay. A wide variety of coils, contacts, contact spring arrangements and mounting facilities makes this truly the "all-purpose" relay.



CLASS C

WHERE SIZE LIMITS RELAY SELECTION

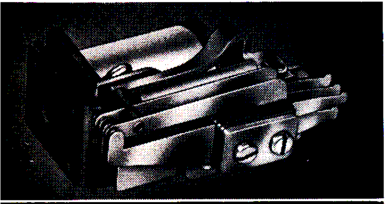
This compact relay combines unusual dependability and surprisingly long service life in a space about half of the size of the average relay of equal rating. Use it where space and weight saving are important. Has the same basic design characteristics as the Class B relay. Can be used for high-speed or delayed operation.



CLASS S

FOR EXACTING MINIATURE APPLICATIONS

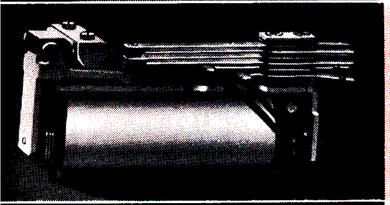
Specify this relay for aircraft use, where a small, light relay is required, resistant to shock and vibration. Will meet most standard 10G vibration tests. Can be relied upon for fast pulse response because of its small mass and slight self-inductance. Voltages shown are nominal. Series SQPC available for printed circuits.



CLASS Z

FOR MAXIMUM TIMING WITH REDUCED SIZE

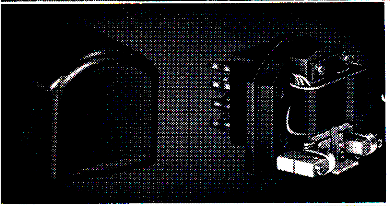
Similar to Class A relay, but smaller and does not provide the same sensitivity and range of time delay characteristics or the exceptionally large number of contact springs. Choose Class Z relays where a small, light relay is needed but long life or time delay is of greater importance than extremely small size.



CLASS F

FOR A.C. OPERATION

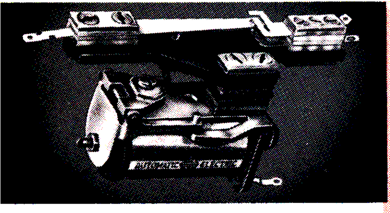
For use when the number of relays doesn't justify a rectifier, and when operate and release time delays are not a factor. An inexpensive rectifier can be used with any of the above d.c. relays when operate and release timing is required. The Class F relay features low power consumption, while the Class B has superior life expectancy and handles heavier contact loads.



POLARIZED

WHEN SENSITIVITY TO MAGNITUDE AND DIRECTION OF CURRENT ARE REQUIRED

Series PHD and PLD are available for either "2-position" or "3-position" operation. Series PTW provides only "2-position" operation. "2-position" relays "stick" operated until current is reversed; "3-position" operation provides a neutral position for the armature when no current is flowing.



SPECIAL PURPOSE

TO SUIT YOUR APPLICATION

We can usually make assemblies of Automatic Electric relays with modifications to suit your special applications. The Class E Video relay, illustrated here, is an example. Others are designed for power applications, electro-mechanical interlocking, marginal operation, mechanical locking, micrometer adjusting, and the simultaneous closing of up to 35 circuits (BAR relay).

SERIES	OPERATING TIME, SECONDS	RELEASE TIME, SECONDS	MAXIMUM COIL VOLTAGE	MAXIMUM NO. OF STANDARD CONTACTS	TYPE OF CONTACTS†††	WEIGHT	DIMENSIONS (MAX.) IN.
BQA	0.002-0.030	0.005-0.050	250 dc	24 Spgs.	Code 0—18 ga. Twin	8-12 oz.	4-3/32 x 2-5/16 x 1
BSO	0.040-0.120	0.025-0.350	135 dc	**24 Spgs.		8-14 oz.	4-3/32 x 2-5/16 x 1
BSR	0.004-0.035	0.035-0.600	135 dc	*6 Spgs.		8-14 oz.	4-3/32 x 1-7/8 x 1
BSA	0.020-0.055	0.035-0.600	250 dc	*6 Spgs.		8-14 oz.	4-3/32 x 1-7/8 x 1
BFA	0.010-0.025	0.008-0.020	230 ac	24 Spgs.		8-14 oz.	4-3/32 x 2-5/16 x 1
BMS	0.010-0.030	0.015-0.050	250 dc	***2 Form C	Snap-action	7-11 oz.	4-3/32 x 2-17/32 x 1-23/32
EQA	0.002-0.030	0.005-0.025	150 dc	26 Spgs.	Code 0—18 ga. Twin	2-3 oz.	2-1/4 x 1-23/32 x 1-1/8
ESO	0.015-0.050	0.025-0.125	110 dc	26 Spgs.			
ESR	0.005-0.030	0.025-0.125	110 dc	*6 Spgs.			
ESA	0.015-0.030	0.050-0.125	110 dc	*6 Spgs.			
EFA	0.005-0.025	0.005-0.025	220 ac	12 Spgs.			
EMS	0.010-0.030	0.015-0.030	150 dc	2 Form C	Snap-action		2-1/4 x 1-23/32 x 2-3/16
AQA	0.002-0.025	0.005-0.025	250 dc	26 Spgs.	Code 4—18 ga.	8-12 oz.	4-3/32 x 2-3/16 x 1-7/16
ASO	0.040-0.120	0.020-0.250	135 dc	26 Spgs.		8-14 oz.	4-3/32 x 2-3/16 x 1-7/16
ASR	0.004-0.025	0.020-0.350	135 dc	*6 Spgs.		8-12 oz.	4-3/32 x 2 x 1-7/16
ASA	0.010-0.050	0.020-0.350	250 dc	*6 Spgs.		8-12 oz.	4-3/32 x 2 x 1-7/16
AWS	††Up to 2	0.005-0.025	250 dc	1 Form A		7-11 oz.	4-3/32 x 2-3/4 x 1-7/16
AVR	0.002-0.025	††1 to 15	250 dc	Special		8-12 oz.	4-1/4 x 2 x 1
AMC	0.210-0.280	0.300-0.345	250 dc	2	Mercury	12-16 oz.	4-3/4 x 3-1/16 x 3
CQA	0.005-0.035	0.005-0.025	150 dc	12 Spgs.	Code 0—18 ga. Twin	4-oz.	4-1/32 x 2-3/16 x 21/32
CSA	0.010-0.040	0.015-0.200	150 dc	12 Spgs.	Code 0—18 ga. Twin	4-oz.	4-1/32 x 2-3/16 x 21/32
CMS	0.010-0.035	0.010-0.050	150 dc	1 Form C	Snap-action	6 oz.	3-13/16 x 2-7/16 x 1
SQA	0.002-0.016	0.005-0.085	†115 dc	9 Spgs.	Code 0—20 ga. Twin	2 oz.	1-17/32 x 2 x 11/16
SQD	0.002-0.030	0.005-0.085	†115 dc	18 Spgs.		2- 3 oz.	1-17/32 x 2 x 1
SQPC	0.002-0.030	0.005-0.085	†115 dc	18 Spgs.		2- 3 oz.	1-17/32 x 2 x 1
S-Power	0.005-0.016	0.005-0.010	115 dc	1 Make	Silver-Tungsten	12 oz.	1-1/2 x 1-1/2 x 1-1/4
ZQA	0.002-0.025	0.005-0.025	135 dc	13 Spgs.	Code 4—18 ga.	4- 6 oz.	2-1/2 x 2-3/4 x 1-1/2
ZSO	0.010-0.050	0.050-0.150	115 dc	13 Spgs.		4- 6 oz.	2-1/2 x 2-3/4 x 1-1/2
ZSR	0.003-0.010	0.050-0.200	115 dc	*6 Spgs.		4- 6 oz.	2-1/2 x 2-3/4 x 1-1/2
ZSA	0.010-0.040	0.050-0.200	135 dc	*6 Spgs.		4- 6 oz.	2-1/2 x 2-3/4 x 1-1/2
ZMS	0.010-0.040	0.005-0.200	135 dc	***2 Form C	Snap-action	8-10 oz.	2-1/2 x 2-5/8 x 2-1/4
ZFA	0.010-0.025	0.008-0.020	115 ac	13 Spgs.	Code 4—18 ga.	4- 6 oz.	2-1/2 x 2-3/4 x 1-5/16
Type 18	0.002-0.025	0.005-0.025	12 or 24 dc	10 Spgs.	Code 9—18 ga.	4- 6 oz.	2-1/2 x 2-1/4 x 1-1/4
FQA	0.002-0.025	0.005-0.040	To 230 (16-66 cycles)	12 Spgs.	Code 4—18 ga.	9-13 oz.	4 x 1-15/16 x 1-1/4
BFA	0.010-0.025	0.008-0.020	To 230 (20-60 cycles)	24 Spgs.	Code 0—18 ga.	8-14 oz.	4-3/32 x 2-5/16 x 1
EFA	0.005-0.025	0.005-0.025	To 220 ac	12 Spgs.	Code 0—18 ga.	2-3 oz.	2-1/4 x 1-23/32 x 1-1/8
FMS	0.002-0.020	0.002-0.020	To 240 (16-66 cycles)	2 Form C	Snap-action	10-14 oz.	3-1/2 x 2-3/8 x 2-3/8
FMC	0.298-0.333	0.290-0.350	To 240 (16-66 cycles)	2	Merc.-Glass	14-18 oz.	4-5/8 x 2-3/4 x 2-3/4
ZFA	0.010-0.025	0.008-0.020	To 115 (20-60 cycles)	13 Spgs.	Code 4—18 ga.	4- 6 oz.	2-1/2 x 2-7/8 x 1-11/32
PLD	0.003-0.010	0.022-0.047	350 dc	6 each side	Code 4—18 ga.	28 oz.	4 x 3-1/4 x 2
PHD	0.006-0.027	0.065-0.075	350 dc	6 each side	Code 4—14 ga.	27-37 oz.	4-13/16 x 2-3/4 x 3
PTW****	0.007 Minimum	0.0002 Approx. Travel Time		1 Form C	Tungsten Carbide or Palladium	14 oz.	2-7/8 x 2-1/4 x 3-5/16

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*More contacts can be accommodated at a sacrifice of operating speed and release time delay.

**Up to 0.600 sec. release time on BSO relay with 6 springs maximum.

***With one snap-action switch and one open contact assembly with 8 springs maximum.

****Available also with octal plug or pin-type plug (to fit WE Co. 255 applications).

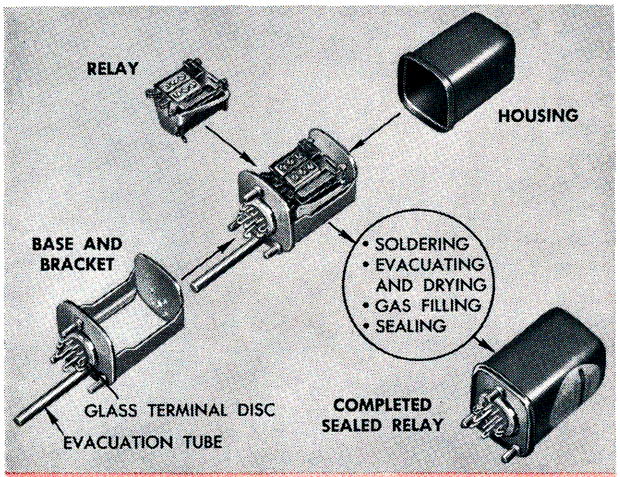
†Higher voltage obtainable with oversize coils.

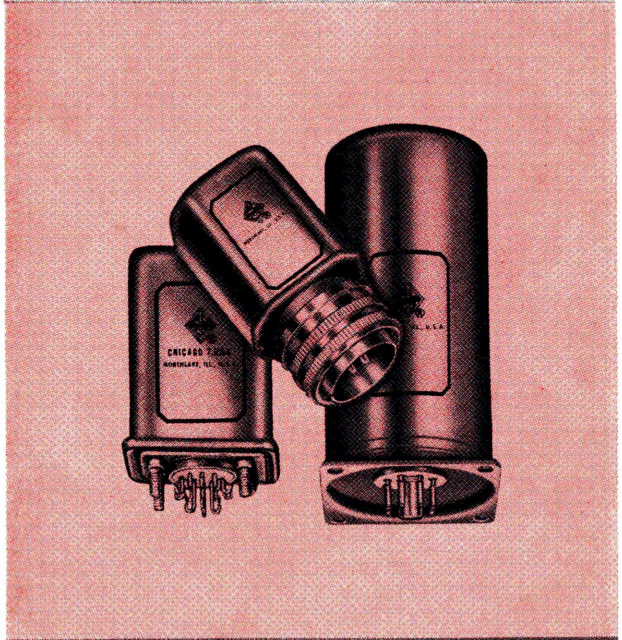
††Timing value obtained in conjunction with a Series ASO relay and wired circuit specified in Catalog 4071.

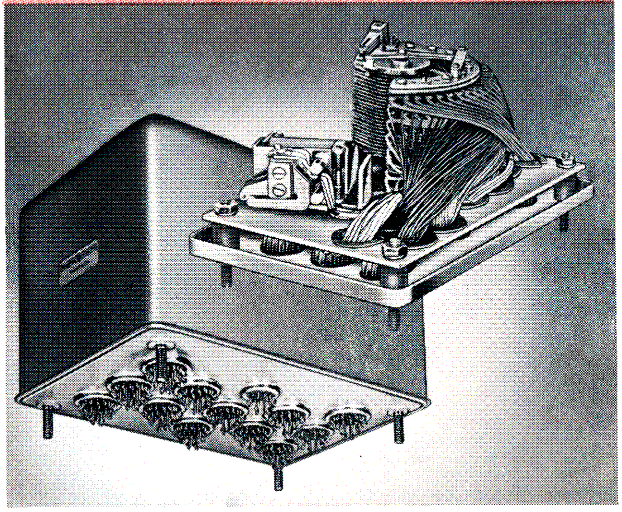
†††Most relays can be furnished with special heavy-duty contacts.

Note: Minimum operate time and minimum release time usually cannot both be secured on any one relay; a relay with minimum operate time may approach the maximum release time for its particular type.

HERMETIC-SEAL ENCLOSURES







Automatic Electric hermetically sealed relays and switches are used in any industrial or military application where complete protection against all harmful atmospheric conditions and/or tampering is a prime requirement. In industry, use them in arc welding equipment, in railroad installations, in dirty or hazardous locations such as oil refineries, steel mills, and ordnance plants. In military applications, use them in equipment that will be subjected to high humidity, fungi, salt spray, sand, or varying air pressure.

In all of these applications, Automatic Electric hermetically sealed relays and switches assure continuously uniform performance, for they operate in an "ideal" atmosphere. In this atmosphere the relay or switch is positively protected from all harmful effects. The atmosphere is actually a part of the relay or switch and it is sealed into a metal container by the latest methods.

In the hermetic sealing process, the relay or switch is mounted firmly in a combination base and bracket to which is attached an evacuation tube. A glass terminal disk is hermetically sealed to this base, and the relay or switch is wired and soldered to it. Then a metal housing is fitted over this partial assembly. The edge of the housing is hydraulically crimped over the base, and the seam soldered to form a tight hermetic seal.

Then the assembly is attached to a high vacuum pump and is evacuated to remove moisture and gases. While under vacuum, the enclosure is tested for leaks. Then it is flushed with dry nitrogen, and again evacuated. Finally, the enclosure is filled with dry gas (usually nitrogen) to a pressure of at least one atmosphere, and the evacuation tube is closed and sealed. The completed assembly is painted for additional protection against corrosion, and is labeled in compliance with the Armed Service or other specifications. The result is a hermetically sealed relay or switch that satisfies the requirements of temperature, humidity, and immersion tests as described in service specifications currently in force.

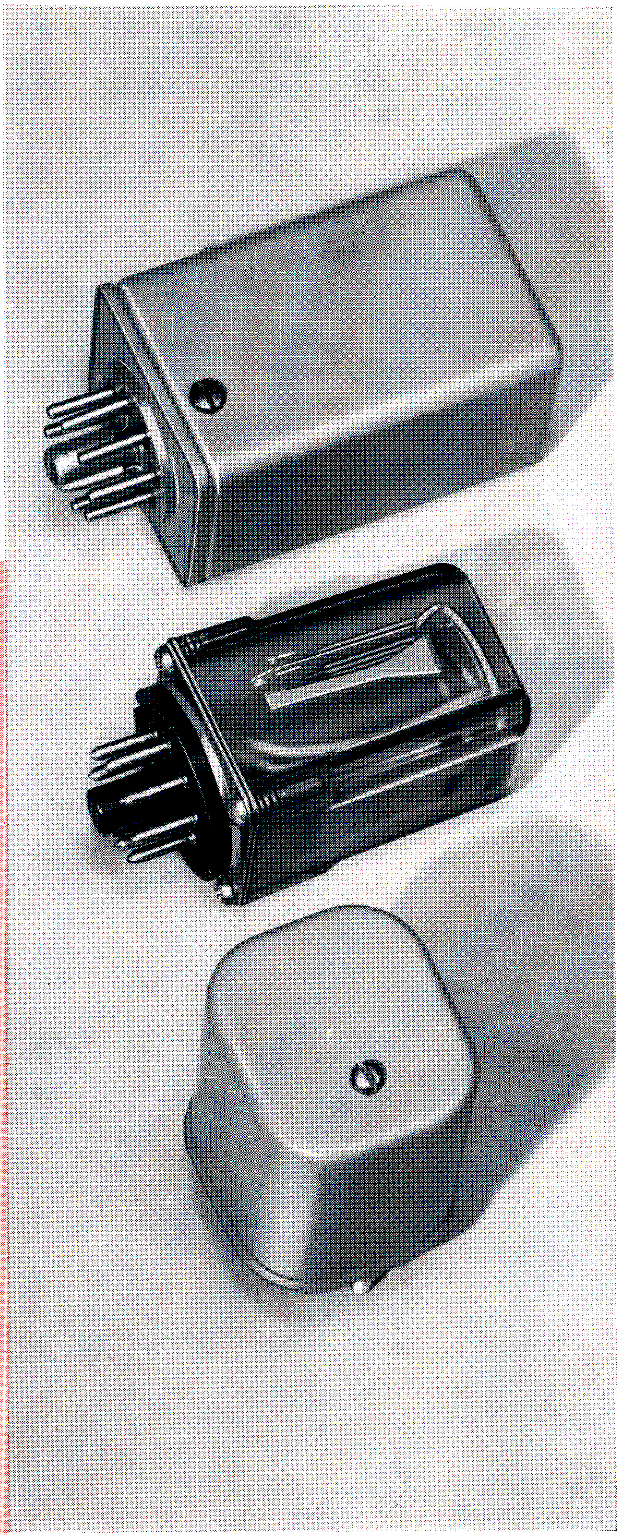
Enclosures are available in a variety of sizes and shapes to meet virtually any engineering requirements. Many types of relays and switches can be sealed in these enclosures. Some hermetic enclosure will exactly satisfy the needs of your particular problem. For specific information on the dimensions of these enclosures and the types of relays and switches that can be sealed in them write for Catalog 4083.

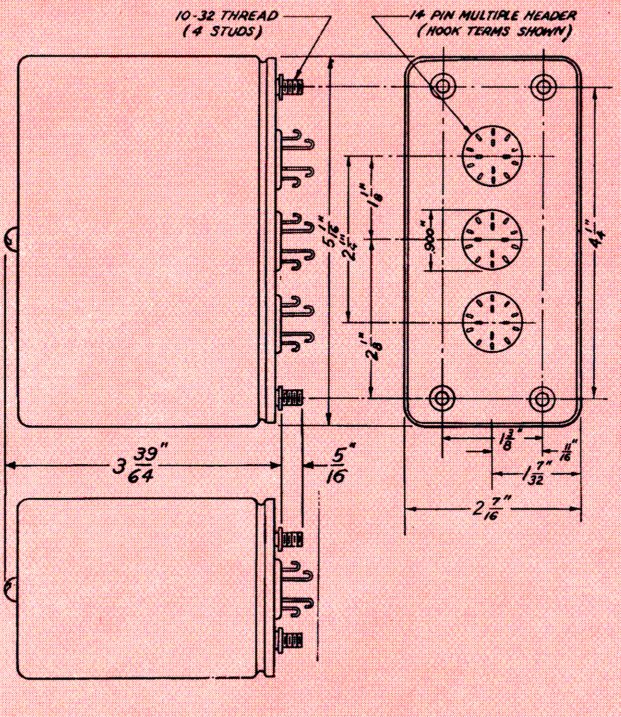
PROTECTIVE ENCLOSURES

(NOT HERMETICALLY SEALED)

The same type of enclosure as is employed for hermetic sealing can be used as a slip-on cover for dust protection. In such a case the relay or rotary stepping switch is mounted and wired to the base in the same way as for hermetic sealing. The cover flange is left uncrimped and serves as a pressure fit between base and cover. A self-tapping screw is usually used to secure the cover in place.

Most of the hermetic-type enclosures used for relays and switches are available for this special form of protection. The Class S relay with not to exceed three springs per pile-up with Code No. 0-20 ga. contacts is available in a clear plastic case with octal plug mounting (shown at right, center). For specific information, and dimensions of protective enclosures, write for Catalog 4083.





AE 6100 PROTECTIVE ENCLOSURE—the size of this enclosure permits housing of one Type 44 rotary stepping switch with 1 to 6 levels. This enclosure can also be used for 1 OCS relay with 1, 2 or 3 cams; 2 class Z relays, or many combinations of Automatic Electric relays.

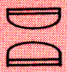
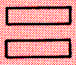
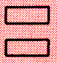
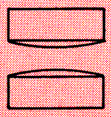
SIZES, SHAPES, RATINGS OF CONTACTS

The Relay and Rotary Stepping Switch contacts listed here are applicable for almost any control purpose. Many can be supplied as twin contacts, that is, two contacts mounted on separate arms of each contact spring; the circuit is thus completed through one contact if the other contact is held open by dust or grit. Twin contacts are used also to increase current-carrying capacity. A pair of twin contacts, properly adjusted, have almost twice the carrying capacity of a single contact, but usually do not provide higher rating of contacts for breaking or making circuits.

Contact rating is affected by relay characteristics; size, shape and material of spring; and contact assembly.

All moderately heavy to heavy inductive load circuits should have suitable spark suppression.

RELAY CONTACTS

CODE	MATERIAL	BREAK OR MAKE, LOAD	WILL CARRY LOAD	REMARKS	DIAM., IN.	HEIGHT, IN.	SHAPE
0-20	Palladium-Silver	50 W (Max. 1 amp. N.I.)* 135 W (Max. ½ amp) inductive	135 W (Max. 2 amps)	See Code 0-18	0.055	0.020	
3-18	Gold Alloy			Recommended for low-level instrument circuits.	0.067	0.020	
0-18	Palladium-Silver	135 W (Max. 3 amps. N.I.)	150 W (Max. 3 amps)	Generally recommended. Resistant to tarnish, and non-microphonic (with standard adjustments.)			
9-18	Platinum-Ruthenium	Same as Code 4-18	Same as Code 4-18	Much more resistant to mechanical wear than Code 0 contacts—hence longer lived.			
4-18	Palladium	135 W (Max. 3 amps. N.I.)	150 W (Max. 3 amps)	See Code 0-18			
4-14	Palladium	150 W (Max. 3 amps. N.I.)	150 W (Max. 3 amps)	See Code 0-18	0.084	0.031	
9-14	Platinum-Ruthenium	Same as Code 4-14	Same as Code 4-14	See Code 9-18			
0-14	Palladium-Silver	150 W (Max. 3 amps. N.I.)	150 W (Max. 3 amps)	See Code 0-18			
Tungsten	Tungsten	450 W (Max. 2 amps. N.I.)	450 W (Max. 2 amps)	Use in highly inductive, low current circuits.	0.125	0.063	
Laminated Silver	Laminated Silver	450 W (Max. 4 amps. N.I.)	450 W (Max. 4 amps)		3/16	3/64	
Tungsten Silver	Tungsten Silver Alloy	450 W (Max. 4 amps) 575 W (Max. 5 amps)	650 W (Max. 6 amps) 1150 W (Max. 10 amps)		3/16 1/4	1/16 1/16	
Snap-Action Switch A.C.		AC-NI LOADS Break 10 amps, 115v Make 6 amps, 115v Break 5 amps, 230v Make 3 amps, 230v	Will handle 300 Watt lamp loads (allow for in-rush currents) or the current drain of an average ¼ H P. or a well designed ½ H.P. motor.	Also available for loads up to 30 amperes, 220 volts, a.c. on special order.			
Snap-Action Switch D.C.			On special order, magnetic blowout switches up to 15 amperes, d.c.				
Mercury Contact		25 amps, 80 v. (20 amps, 115 v.), 10 amps, 230 v.; D.C. or A.C.—NI loads.			Available in A or B combination only.		

*N.I.—Non-inductive.

How to Order AE Relays

For fastest service, order relays from among the Standard Assemblies on the following pages. The component parts for these are stocked and, therefore, readily available.

When the Standard Assemblies do not meet your requirements, order a Custom Assembly. A 100-page catalog "Relays and Switches for Industrial Control" is available to help you in ordering the exact relay for your application. If you need technical advice, contact the Automatic Electric representative nearest you for prompt, courteous assistance. A list of Automatic Electric district and branch offices is on the back cover.

STANDARD ASSEMBLIES, BQA RELAYS, D.C.

Code 0-18 Gauge, Twin Contacts

The following relays, with Form C ("break-make") contact assemblies, may be used wherever "make", "break", or "break-make" combinations are required.

Resistances and voltages in these tables will give reliable operation with minimum power consumption. For economy, use 800 to 1000-ohm coils on 24 volts, d.c.; 1300 to 2000-ohm coils on 48 volts, d.c.; 2500 to 4000-ohm coils on 115 volts, d.c. At other voltages, good engineering requires that an applied voltage at least 1.5 times the minimum voltage be used. For fastest operate times, this applied voltage may have to be two to five times, or more, above the "just operate" or minimum voltage.

Standard assemblies for 4C, 6C and 8C combinations are furnished as double pile-up relays.

1C Combination

Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Res. Ohms	Cat. No.
.530	11	.0442	12	RJ-58
1.02	14.5	.0320	32	RJ-59
1.39	27	.0187	75	RJ-60
1.77	35	.0142	125	RJ-61
3.39	49	.0097	350	RJ-62
4.02	60	.0080	500	RJ-63
4.96	75	.0062	800	RJ-64
5.27	87	.0052	1000	RJ-65
6.61	125	.0041	1600	RJ-66
8.47	160	.0033	2500	RJ-67
13.12	200	.0032	4000	RJ-68
13.52	250	.0020	6500	RJ-69
18.64	340	.0016	11300	RJ-70

2C Combination

Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Res. Ohms	Cat. No.
.758	11	.0632	12	RJ-71
1.36	14.5	.0425	32	RJ-72
1.94	27	.0268	75	RJ-73
2.53	35	.0203	125	RJ-74
5.16	49	.0139	350	RJ-75
5.76	60	.0115	500	RJ-76
7.12	75	.0089	800	RJ-77
7.56	87	.0075	1000	RJ-78
9.44	125	.0059	1600	RJ-79
10.15	160	.0048	2500	RJ-80
15.76	200	.0039	4000	RJ-81
19.37	250	.0029	6500	RJ-82
26.78	340	.0023	11300	RJ-83

3C Combination

Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Res. Ohms	Cat. No.
.903	11	.0753	12	RJ-84
1.62	14.5	.0507	32	RJ-85
2.36	27	.0319	75	RJ-86
3.02	35	.0242	125	RJ-87
5.77	49	.0165	350	RJ-88
6.85	60	.0137	500	RJ-89
8.48	75	.0106	800	RJ-90
9.05	87	.0090	1000	RJ-91
11.26	125	.0070	1600	RJ-92
14.47	160	.0057	2500	RJ-93
18.76	200	.0046	4000	RJ-94
23.07	250	.0035	6500	RJ-95
31.86	340	.0028	11300	RJ-96

4C Combination

Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Res. Ohms	Cat. No.
1.05	11	.088	12	RN-41
2.79	27	.0372	75	RN-42
3.53	35	.0283	125	RN-43
6.66	49	.0190	350	RN-44
8.00	60	.0160	500	RN-45
10.40	87	.0104	1000	RN-46
13.12	125	.0082	1600	RN-47
16.77	160	.0067	2500	RN-48
22.84	200	.0054	4000	RN-49
26.91	250	.0041	6500	RN-50
37.17	340	.0032	11300	RN-51

6C Combination

Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Res. Ohms	Cat. No.
1.30	11	.109	12	RN-52
3.36	27	.0462	75	RN-53
4.36	35	.0350	125	RN-54
8.33	49	.0238	350	RN-55
9.90	60	.0192	500	RN-56
13.00	87	.0130	1000	RN-57
16.24	125	.0101	1600	RN-58
20.90	160	.0083	2500	RN-59
27.04	200	.0067	4000	RN-60
33.28	250	.0051	6500	RN-61
46.10	340	.0040	11300	RN-62

8C Combination

Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Res. Ohms	Cat. No.
1.52	11	.1270	12	RN-63
4.03	27	.0538	75	RN-64
5.10	35	.0408	125	RN-65
9.73	49	.0278	350	RN-66
11.55	60	.0231	500	RN-67
15.20	87	.0152	1000	RN-68
18.88	125	.0118	1600	RN-69
24.37	160	.0097	2500	RN-70
31.52	200	.0078	4000	RN-71
38.87	250	.0059	6500	RN-72
53.67	340	.0047	11300	RN-73

STANDARD ASSEMBLIES, SERIES BFA, A.C.

Code 0-18 Gauge Twin Contacts

Nominal Operate Voltage	Voltage Range	Current Drain R.M.S.—Amps. At Nom. Volt.	D.C. Resis. of Coil, Ohms	Catalog Number	
				1C Comb.	2C Comb.
6	4.5-8	.705-1.58	.37	RK-17	RZ-47
12	8-15	.650-.890	1.16	RK-18	RZ-48
25	18-30	.230-.505	5.5	RK-19	RZ-49
55	45-75	.100-.220	32	RK-20	RZ-50
115	75-135	.025-.082	190	RK-21	RZ-51
230	170-260	.024-.058	450	RK-22	RZ-52

Standard Assemblies for 4C combinations are furnished as double pile-ups.

Nominal Operate Voltage	Voltage Range	Current Drain R.M.S.—Amps. At Nom. Volt.	D.C. Resis. of Coil, Ohms	Catalog Number	
				3C Comb.	4C Comb.
6	4.5-8	1.54-3.00	.228	RK-23	RZ-53
12	8-15	.600-1.44	.85	RK-24	RZ-54
25	18-30	.465-.970	3	RK-25	RZ-55
55	45-75	.235-.640	14	RK-26	RZ-56
115	75-135	.070-.165	100	RK-27	RZ-57
230	170-260	.046-.088	310	RK-28	RZ-58

STANDARD ASSEMBLIES, SERIES EQA D.C.

Code 0-18 Ga., Twin Contacts

The following relays, with Form C ("break-make") contact assemblies, may be used wherever "make", "break", or "break-make" combinations are required.

Resistances and voltages in these tables will give reliable operation with minimum power consumption. For economy, use 200- to 700-ohm coils on 24 volts, d.c.; 1000- to 3000-ohm coils on 48 volts, d.c.; and 8000- to 12,000-ohm coils on 120 volts, d.c. At other voltages, good engineering requires that an applied voltage at least 1.5 times the minimum voltage be used. For fastest operate times, this applied voltage may have to be two to five times, or more, above the "just operate" or minimum voltage.

1C Combination

Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Resis. Ohms	Cat. No.
3.5	18	.040	90	RZ-10
4.5	26	.030	150	RZ-11
7	40	.014	500	RZ-12
13	75	.010	1300	RZ-13
32	160	.004	8000	RZ-14
37	200	.0037	10,000	RZ-15

2C Combination

Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Resis. Ohms	Cat. No.
4.4	18	.049	90	RZ-16
5.8	26	.037	150	RZ-17
10	40	.020	500	RZ-18
17	75	.013	1300	RZ-19
42	160	.0052	8000	RZ-20
48	200	.0048	10,000	RZ-21

3C Combination

Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Resis. Ohms	Cat. No.
4	15	.067	60	RZ-22
7	26	.047	150	RZ-23
12.5	40	.025	500	RZ-24
20	75	.0155	1300	RZ-25
51	160	.0064	8000	RZ-26
60	200	.006	10,000	RZ-27

4C Combination

Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Resis. Ohms	Cat. No.
4.5	15	.075	60	RZ-28
8	26	.054	150	RZ-29
11	36	.037	300	RZ-30
23	75	.0176	1300	RZ-31
57	160	.0072	8000	RZ-32
68	200	.0068	10,000	RZ-33

6C Combination

Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Resis. Ohms	Cat. No.
4	11	.0135	30	RZ-34
7.5	18	.083	90	RZ-35
13	34	.052	250	RZ-36
25.5	62	.0255	1000	RZ-37
60	150	.010	6000	RZ-38
70	180	.0088	8000	RZ-39

8C Combination

Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Resis. Ohms	Cat. No.
4	9	.020	20	RZ-40
8.4	18	.093	90	RZ-41
14	31	.070	200	RZ-42
30	62	.030	1000	RZ-43
61	140	.0122	5000	RZ-44
80	180	.010	8000	RZ-45

NOTE: Standard Assemblies for 4C, 6C and 8C combinations are furnished as double pile-up relays.

STANDARD ASSEMBLIES, SQA RELAYS, D.C.

The following relays, with Form C ("break-make") contact assemblies, may be used wherever "make", "break", or "break-make" combinations are required.

Resistances and voltages in these tables will give reliable operation with minimum power consumption. For economy, use 225- to 750-ohm coils on 24 volts, d.c.; 1500- to 2500-ohm coils on 48 volts, d.c.; and 5000- to 10,000-ohm coils on 110 volts, d.c. At other voltages, good engineering requires that an applied voltage at least 1.5 times the minimum voltage be used. For fastest operate times, this applied voltage may have to be two to five times, or more, above the "just operate" or minimum voltage.

1C Combination

Min. Oper. Volts	*Max. Allow. Volts*	*Min. Oper. Amps.*	*Coil Resis., Ohms.*	*Cat. No.*
4.0	8	.0052	78	RW-38
6.5	15	.0325	200	RW-39
10.5	32	.021	500	RS-61
20.0	56	.010	2000	RW-40
28.0	75	.0093	3000	RW-41
44.0	125	.0063	7000	RW-42

2C Combination

Min. Oper. Volts	*Max. Allow. Volts*	*Min. Oper. Amps.*	*Coil Resis., Ohms*	*Cat. No.*
4.5	8	.058	78	RW-43
7.2	15	.036	200	RW-44
12.0	32	.024	500	RS-62
22.0	56	.0125	1750	RW-45
28.0	75	.0112	2500	RW-46
50.0	125	.0077	6500	RW-47

STANDARD ASSEMBLIES, SQD RELAYS, D.C.

2C Combination

Min. Oper. Volts	*Max. Allow. Volts*	*Min. Oper. Amps*	*Coil Resis. Ohms*	*Cat. No.*
4.0	8	.052	78	RW-48
6.5	15	.033	140	RW-49
12.5	32	.025	500	RS-71
22.0	56	.011	2000	RW-50
35.0	75	.007	5000	RW-51
50.0	140	.005	*10,000	RW-52

4C Combination

Min. Oper. Volts	*Max. Allow. Volts*	*Min. Oper. Amps*	*Coil Resis. Ohms*	*Cat. No.*
4.4	8.0	.088	50	RW-53
7.0	15	.050	140	RW-54
11.0	32	.037	300	RS-72
21.0	56	.018	1200	RW-55
31.0	69	.011	3000	RW-56
60.0	140	.006	*10,000	RW-57

6C Combination

Min. Oper. Volts	*Max. Allow. Volts*	*Min. Oper. Amps*	*Coil Resis Ohms*	*Cat. No.*
4.5	8	.150	30	RW-58
7.8	15	.010	78	RW-59
12.5	32	.055	* 225	RW-60
30.0	56	.030	*1000	RW-61
41.0	69	.017	*2500	RW-62
61.0	125	.012	*5000	RW-63

** Oversize coils only*

STANDARD ASSEMBLIES, SERIES AQA, D.C.

Code 4-18 ga., Single Contacts

The following relays, with Form C ("break-make") contact assemblies, may be used wherever "make", or "break", or "break-make" combinations are required.

Resistance and voltage in these tables will give reliable operation and minimum power consumption. For best engineering economy, use 800 to 1000 ohm coils on 24 volts, d.c.; 1300 to 2000 ohm coils on 48 volts, d.c.; and 2500 to 4000 ohm coils on 115 volts, d.c. At other voltages, good engineering requires an applied voltage at least 1.5 times the minimum voltage. For fastest operate times, applied voltage may have to be as much as five times, or more, above the just operate or minimum voltage.

Standard assemblies for 4C, 6C and 8C combinations are furnished as double pile-up relays.

1C Combination					*2C Combination*					*3C Combination*				
Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Res. Ohms	Cat. No.	Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Res. Ohms	Cat. No.	Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Res. Ohms	Cat. No.
0.76	9	.0757	10	RA-10	1.05	9	.1058	10	RA-23	1.25	9	.1250	10	RA-36
1.29	14	.0512	25	RA-11	1.77	14	.0710	25	RA-24	2.12	14	.0864	25	RA-37
2.21	25	.0294	75	RA-12	3.06	25	.0409	75	RA-25	3.63	25	.0480	75	RA-38
2.78	31	.0224	125	RA-13	3.88	31	.0311	125	RA-26	4.22	31	.0369	125	RA-39
4.26	49	.0142	300	RA-14	5.94	49	.0198	300	RA-27	7.05	49	.0234	300	RA-40
5.59	60	.0123	450	RA-15	7.67	60	.0170	450	RA-28	9.09	60	.0202	450	RA-41
6.90	77	.0092	750	RA-16	9.62	77	.0128	750	RA-29	11.30	77	.0152	750	RA-42
8.30	89	.0083	1000	RA-17	11.56	89	.0115	1000	RA-30	13.10	89	.0137	1000	RA-43
9.88	102	.0076	1300	RA-18	13.72	102	.0105	1300	RA-31	16.25	102	.0125	1300	RA-44
13.25	141	.0053	2500	RA-19	18.57	141	.0074	2500	RA-32	22.00	141	.0088	2500	RA-45
16.17	162	.0049	3300	RA-20	22.44	162	.0068	3300	RA-33	26.40	162	.0080	3300	RA-46
20.80	228	.0032	6500	RA-21	29.64	228	.0045	6500	RA-34	35.10	228	.0054	6500	RA-47
29.38	300	.0026	11300	RA-22	40.90	300	.0036	11300	RA-35	47.46	300	.0042	11300	RA-48

4C Combination					*6C Combination*					*8C Combination*				
Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Res. Ohms	Cat. No.	Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Res. Ohms	Cat. No.	Min. Oper. Volt.	Max. Allow. Volt.	Min. Oper. Amps.	Coil Res. Ohms	Cat. No.
1.45	9	.1470	10	RV-10	1.78	9	.1785	10	RV-23	2.11	9	.2178	10	RV-36
2.45	14	.1000	25	RV-11	2.02	14	.1219	25	RV-24	3.57	14	.1457	25	RV-37
4.20	25	.0560	75	RV-12	5.17	25	.0694	75	RV-25	6.07	25	.0819	75	RV-38
6.25	31	.0428	125	RV-13	6.56	31	.0526	125	RV-26	7.75	31	.0621	125	RV-39
8.16	49	.0282	300	RV-14	10.05	49	.0335	300	RV-27	11.88	49	.0396	300	RV-40
10.53	60	.0234	450	RV-15	12.96	60	.0289	450	RV-28	15.30	60	.0340	450	RV-41
13.20	77	.0176	750	RV-16	16.27	77	.0217	750	RV-29	18.97	77	.0256	750	RV-42
15.80	89	.0158	1000	RV-17	19.50	89	.0156	1000	RV-30	23.10	89	.0231	1000	RV-43
18.85	102	.0143	1300	RV-18	23.14	102	.0235	1300	RV-31	27.43	102	.0211	1300	RV-44
25.50	141	.0102	2500	RV-19	31.25	141	.0125	2500	RV-32	37.00	141	.0146	2500	RV-45
30.69	162	.0093	3300	RV-20	37.95	162	.0114	3300	RV-33	44.55	162	.0136	3300	RV-46
40.30	228	.0063	6500	RV-21	50.05	228	.0076	6500	RV-34	59.15	228	.0099	6500	RV-47
55.37	309	.0049	11300	RV-22	68.93	300	.0061	11300	RV-35	81.36	300	.0032	11300	RV-48

STANDARD ASSEMBLIES, SERIES FQA RELAYS 50 TO 60 CYCLE, A.C.

Code 4-18 Gauge Single Contact

The following relays, with Form C (break-make) contact assemblies, may be used wherever Form A (make), Form B (break), or Form C (break-make) combinations are required. Cover *is not included.*

Nominal Operate Voltage	*Voltage Range*	*Current Drain R.M.S. - Amperes at Nominal Voltage*	*D.C. Res. of Coils, Ohms*	*Contact Forms and Catalog Numbers*			
				1C	*2C*	*3C*	*4C*
115	75-135	0.025-0.071	93	—	—	RW-28	RW-35
†115	75-135	0.047-0.058	130	RA-54	RA-61	RW-29	RW-36
†115	95-170	0.025-0.032	200	RA-53	RA-60	—	—
220	170-270	0.040-0.0415	455	RA-55	RA-62	RW-30	RW-37

† For maximum dependability, use low resistance coils. For minimum current consumption, high resistance coil may be used.

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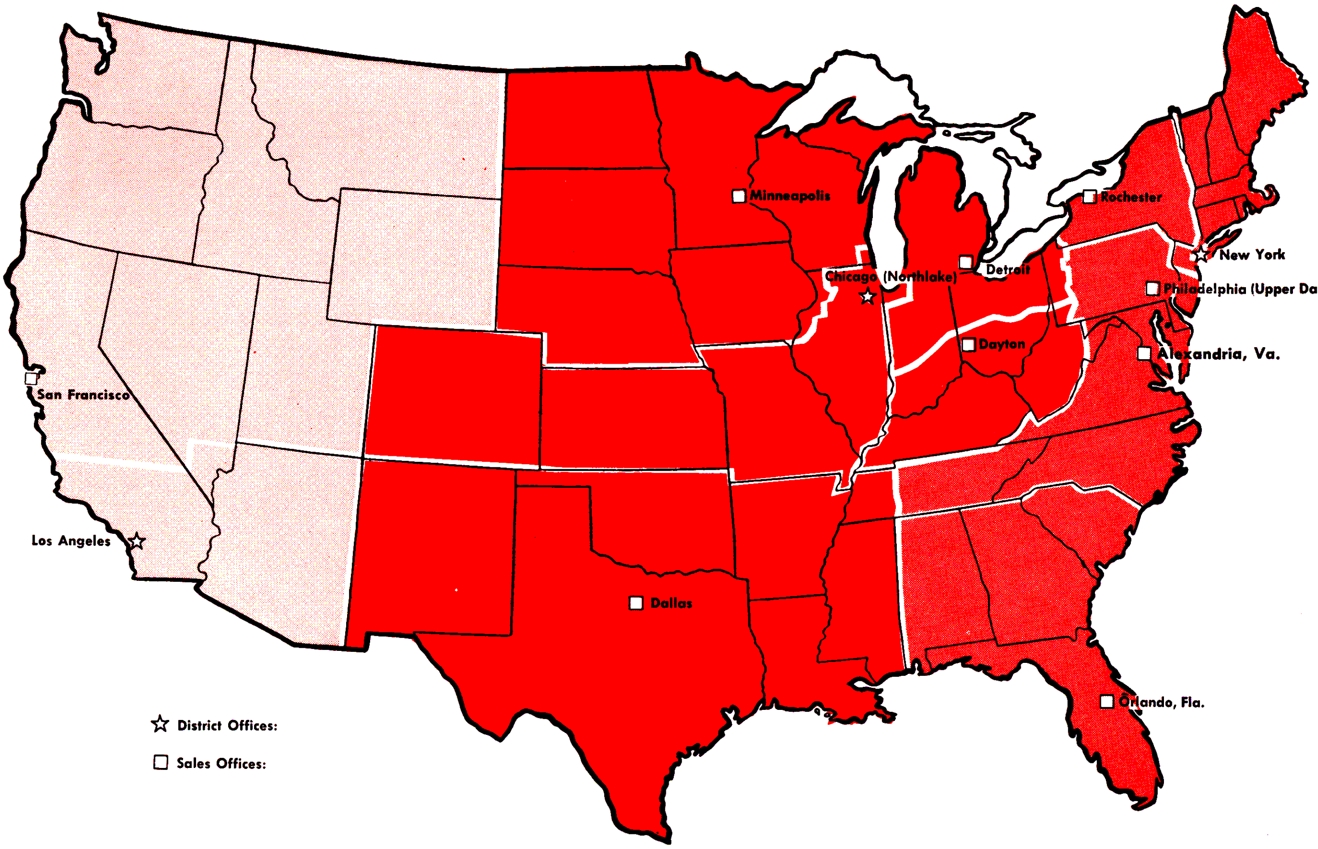

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